

**APPLICATION**

**FOR UNITED STATES LETTERS PATENT**

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**SPECIFICATION**

TO ALL WHOM IT MAY CONCERN:

BE IT KNOWN THAT I, **Richard J. Duval**, a citizen of Canada, have invented a  
new and useful optical stitch regulator system of which the following is a specification:

1                                   **Optical Stitch Regulator System**

2  
3  
4                                   **CROSS REFERENCE TO RELATED APPLICATIONS**

5  
6                                   Not applicable to this application.  
7  
8

9  
10                                   **STATEMENT REGARDING FEDERALLY**  
11                                   **SPONSORED RESEARCH OR DEVELOPMENT**

12  
13                                   Not applicable to this application.  
14

15  
16                                   **BACKGROUND OF THE INVENTION**

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18  
19  
20                                   **Field of the Invention**

21  
22                                   The present invention relates generally to sewing machine stitch regulators and  
23                                   more specifically it relates to an optical stitch regulator system for efficiently regulating  
24                                   the stitch length and stitch frequency of a sewing machine.  
25

26  
27                                   **Description of the Related Art**

28  
29                                   Conventional stitch regulators for sewing machines have been in use for years.  
30                                   Conventional stitch regulators utilize wheel based encoders that are attached to the  
31                                   frame of the sewing machine.  
32

1           One of the problems with conventional stitch regulators is that they require  
2 multiple wheel based encoders – one for each axis of movement. A further problem  
3 with conventional stitch regulators is that they must be utilized upon a straight and  
4 smooth surface. A further problem with conventional stitch regulators is that they are  
5 dependent upon equipment installed upon the XY carriages to provide the motion  
6 feedback of the piece being sewn. Another problem with conventional stitch regulators  
7 is that they require external wiring and encoders which can be damaged. Conventional  
8 stitch regulators utilize mechanical feedback devices that are dependent upon the XY  
9 carriages of the sewing machine and that can be damaged during operation of the  
10 sewing machine.

11

12           In these respects, the optical stitch regulator system according to the present  
13 invention substantially departs from the conventional concepts and designs of the prior  
14 art, and in so doing provides an apparatus primarily developed for the purpose of  
15 efficiently regulating the stitch length and stitch frequency of a sewing machine.

16

17

1

2                   **BRIEF SUMMARY OF THE INVENTION**

3

4           In view of the foregoing disadvantages inherent in the known types of stitch  
5 regulators now present in the prior art, the present invention provides a new optical  
6 stitch regulator system construction wherein the same can be utilized for efficiently  
7 regulating the stitch length and stitch frequency of a sewing machine.

8

9           The general purpose of the present invention, which will be described  
10 subsequently in greater detail, is to provide a new optical stitch regulator system that  
11 has many of the advantages of the stitch regulators mentioned heretofore and many  
12 novel features that result in a new optical stitch regulator system which is not  
13 anticipated, rendered obvious, suggested, or even implied by any of the prior art stitch  
14 regulators, either alone or in any combination thereof.

15

16           To attain this, the present invention generally comprises an optical sensor within  
17 or external of the sewing platform of a sewing machine for sensing the motion of the  
18 fabric being sewn. The motion data is communicated to a control unit which  
19 communicates with the sewing machine for controlling the stitch length and frequency.

20

21           There has thus been outlined, rather broadly, the more important features of the  
22 invention in order that the detailed description thereof may be better understood, and in  
23 order that the present contribution to the art may be better appreciated. There are  
24 additional features of the invention that will be described hereinafter and that will form  
25 the subject matter of the claims appended hereto.

26

27           In this respect, before explaining at least one embodiment of the invention in  
28 detail, it is to be understood that the invention is not limited in its application to the  
29 details of construction and to the arrangements of the components set forth in the

1 following description or illustrated in the drawings. The invention is capable of other  
2 embodiments and of being practiced and carried out in various ways. Also, it is to be  
3 understood that the phraseology and terminology employed herein are for the purpose  
4 of the description and should not be regarded as limiting.

5  
6 A primary object of the present invention is to provide an optical stitch regulator  
7 system that will overcome the shortcomings of the prior art devices.

8  
9 A second object is to provide an optical stitch regulator system for efficiently  
10 regulating the stitch length and stitch frequency of a sewing machine.

11  
12 Another object is to provide an optical stitch regulator system that does not  
13 require external or mechanical feedback devices.

14  
15 An additional object is to provide an optical stitch regulator system that can be  
16 self-contained within a sewing machine.

17  
18 A further object is to provide an optical stitch regulator system that may be  
19 utilized within new or existing sewing machines.

20  
21 Another object is to provide an optical stitch regulator system that provides  
22 motion feedback of the fabric being sewn independent of the carriage assemblies.

23  
24 Other objects and advantages of the present invention will become obvious to the  
25 reader and it is intended that these objects and advantages are within the scope of the  
26 present invention.

27  
28 To the accomplishment of the above and related objects, this invention may be  
29 embodied in the form illustrated in the accompanying drawings, attention being called

1 to the fact, however, that the drawings are illustrative only, and that changes may be  
2 made in the specific construction illustrated and described within the scope of the  
3 appended claims.

1  
2                   **BRIEF DESCRIPTION OF THE DRAWINGS**  
3

4           Various other objects, features and attendant advantages of the present invention  
5 will become fully appreciated as the same becomes better understood when considered  
6 in conjunction with the accompanying drawings, in which like reference characters  
7 designate the same or similar parts throughout the several views, and wherein:  
8

9           FIG. 1 is an upper perspective view of the present invention.  
10

11          FIG. 2 is a magnified upper perspective view of the present invention.  
12

13          FIG. 3 is a side view of the present invention.  
14

15          FIG. 4 is an upper perspective view of the present invention sewing a piece of  
16 fabric.  
17

18          FIG. 5 is a side cutaway view of the present invention sewing a piece of fabric.  
19

20          FIG. 6 is an upper perspective view of an alternative embodiment illustrating an  
21 exemplary aftermarket attachment.  
22

23          FIG. 7 is a side view of a second alternative embodiment illustrating an  
24 exemplary aftermarket attachment.  
25

26          FIG. 8 is a block diagram of the present invention.  
27

1           FIG. 9 illustrates a third alternative embodiment wherein the optical sensors are  
2   positioned around the needle for determining when a piece of fabric is entering the  
3   sewing area of the needle.



1

2 **DETAILED DESCRIPTION OF THE INVENTION**

3

4 **A. Overview**

5 Turning now descriptively to the drawings, in which similar reference characters  
6 denote similar elements throughout the several views, FIGS. 1 through 9 illustrate an  
7 optical stitch regulator system 10, which comprises an optical sensor 30 within or  
8 external of the sewing platform 24 of a sewing machine 20 for sensing the motion of  
9 the fabric 12 being sewn. The motion data is communicated to a control unit 40 which  
10 communicates with the sewing machine 20 for controlling the stitch length and  
11 frequency.

12

13 **B. Sewing Machine**

14 The sewing machine 20 may be comprised of any conventional sewing machine  
15 20 (e.g. personal, commercial, industrial). The sewing machine 20 may have various  
16 structures and functionality other than shown in Figures 1 through 7 of the drawings.  
17 For example, the sewing machine 20 may be comprised of a long arm quilting machine  
18 wherein the needle 22 is moved relative to the fabric 12 by utilizing carriages to move  
19 the needle 22 relative to a fabric 12.

20

21 The sewing machine 20 may have its own internal control unit 40 for controlling  
22 the stitch length based upon the movement feedback from the optical sensor 30. If the  
23 sewing machine 20 does not have an internal control unit 40, then an external control  
24 unit 40 is in communication with the sewing machine 20. The control unit 40 controls  
25 the motor speed of the sewing machine 20 based upon the movement feedback (e.g.  
26 direction, velocity) from the optical sensor 30 so as to maintain a consistent and desired  
27 stitching pattern of the fabric 12. For example, if the optical sensor 30 provides  
28 movement feedback that the fabric 12 entry velocity has increased, then the sewing  
29 machine 20 will increase the motor speed accordingly.

1

2 **C. Optical Sensor**

3 One or more optical sensors **30** are preferably attached to the sewing machine **20**  
4 or a sewing machine carriage for measuring a movement (e.g. direction, velocity) of a  
5 piece of fabric **12** being sewn. It can be appreciated that the optical sensors **30** may be  
6 attached to a structure external of the sewing machine **20** or the sewing machine  
7 carriage. The optical sensor **30** is in communication with the sewing machine **20**  
8 regarding the movement of the fabric **12** so that the sewing machine **20** may adjust the  
9 motor accordingly to provide a desired stitching pattern.

10

11 The optical sensor **30** is preferably positioned within a sewing platform **24** of  
12 the sewing machine **20** as shown in Figures 1 through 6 of the drawings. The optical  
13 sensor **30** is preferably directed substantially upwardly towards the lower surface of the  
14 fabric **12** being sewn as best illustrated in Figures 3 and 5 of the drawings. The optical  
15 sensor **30** preferably extends a finite distance above the sewing platform **24** of the  
16 sewing machine **20** to maintain constant contact with the fabric **12** as best illustrated in  
17 Figure 5 of the drawings.

18

19 The optical sensor **30** preferably has a curved outer lens as best shown in  
20 Figures 3 and 5 of the drawings. Alternatively, the optical sensor **30** may also have a  
21 flat outer lens as can also be appreciated.

22

23 The optical sensor **30** is preferably positioned near the needle **22** of the sewing  
24 machine **20** as shown in Figures 1, 2 and 5 of the drawings. With the optical sensor **30**  
25 positioned in front of the needle **22**, the optical sensor **30** is capable of measuring the  
26 movement of the fabric **12** entering the needle **22**.

27

1           The optical sensor **30** is capable of measuring at least one direction of the  
2 movement (e.g. an X-axis, Y-axis). The optical sensor **30** is also preferably capable of  
3 measuring a velocity of the movement.  
4

5           The optical sensor **30** is preferably comprised of a combination light source and  
6 a light receiver similar in technology to that commonly utilized within an optical  
7 computer mouse. The light receiver detects light reflected by a piece of fabric **12** and  
8 based upon this information is able to calculate the relative movement of the fabric **12**  
9 with respect to the sewing machine **20**. The light source may be a light emitting diode  
10 or other commonly utilized light source. U.S. Patent No. 6,501,460 teaches a "light-  
11 receiving unit for optical mouse" which is hereby incorporated by reference for  
12 teaching an exemplary light source that may be utilized within the present invention.  
13

14           Figure 9 illustrates utilizing more than one optical sensor **30** positioned about  
15 various sides of the needle **22** for determining when a piece of fabric **12** enters the  
16 sewing area of the needle **22**. By positioning the optical sensors **30** about four or more  
17 sides of the sewing area, it can be determined if a piece of fabric **12** is entering the  
18 sewing area from various angles and approaches. It can be appreciated the plurality of  
19 optical sensors **30** shown in Figure 9 may also extend from above the fabric **12** or from  
20 a sewing machine carriage.  
21

#### 22   ***D. Control Unit***

23           The control unit **40** is in communication between the optical sensor **30** and the  
24 sewing machine **20** as shown in Figure 8 of the drawings. The control unit **40** may be  
25 internal or external (Figures 6 and 7) of the sewing machine **20**. The control unit **40**  
26 may also be integrated within the optical sensor **30**.  
27

28           The control unit **40** is preferably comprised of a motion interpretation module  
29 that transmits movement information to the sewing machine **20** and thereby controls the

1 speed of the sewing machine 20 based upon the movement of the fabric 12. The motor  
2 control module within the sewing machine 20 receives the movement data from the  
3 control unit 40 (or directly from the optical sensor 30) and then controls the motor of  
4 the sewing machine 20 accordingly. The control unit 40 may include various other  
5 control features such as control knobs for controlling the stitching pattern and the like.

#### 6 7 ***E. Support Member***

8 Alternatively, the optical sensor 30 is directed downwardly as shown in Figure 7  
9 of the drawings. A support member 50 is attached to a portion of the sewing machine  
10 20 and supports the optical sensor 30 in a downward manner. It is preferable that the  
11 optical sensor 30 be positioned relatively close to the upper surface of the fabric 12  
12 being sewn. An attachment member 52 (e.g. band) or other attachment means attaches  
13 the support member 50 to the upper portion of the sewing machine 20 as further shown  
14 in Figure 7 of the drawings.

#### 15 16 ***F. Operation of Invention***

17 In use, the user positions the fabric 12 to be sewn upon the sewing platform 24  
18 of the sewing machine 20. The sewing machine 20 is preferably preset to a desired  
19 stitching pattern. The user then causes the fabric 12 to move relative to the needle 22  
20 of the sewing machine 20 and the sewing machine 20 begins to sew the fabric 12 by  
21 causing the needle 22 to reciprocate in a desired frequency.

22  
23 The optical sensor 30 senses the movement of the fabric 12 with respect to the  
24 needle 22 and then provides this movement data to the control unit 40. The control unit  
25 40 then communicates with the sewing machine 20 and the motor of the sewing  
26 machine 20 is adjusted accordingly. For example, if the fabric 12 speed is increased  
27 then the sewing machine 20 will increase the motor speed to increase the frequency of  
28 the needle 22 movement. If the fabric 12 speed is decreased then the sewing machine  
29 20 will decrease the motor speed to decrease the frequency of the needle 22 movement.

1 This allows the sewing machine **20** to provide a consistent stitching pattern regardless  
2 of the movement of the fabric **12**.

3

4       What has been described and illustrated herein is a preferred embodiment of the  
5 invention along with some of its variations. The terms, descriptions and figures used  
6 herein are set forth by way of illustration only and are not meant as limitations. Those  
7 skilled in the art will recognize that many variations are possible within the spirit and  
8 scope of the invention, which is intended to be defined by the following claims (and  
9 their equivalents) in which all terms are meant in their broadest reasonable sense unless  
10 otherwise indicated. Any headings utilized within the description are for convenience  
11 only and have no legal or limiting effect.